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# LITTORAL COMBAT SHIP

Navy Complied with Regulations in Accepting Two Lead Ships, but Quality Problems Persisted after Delivery

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## Why GAO Did This Study

GAO has reported extensively on LCS—an innovative Navy program, consisting of a ship and its mission packages. The Navy bought the first two ships using research and development funds, initially planning to experiment with them to test concepts and determine the best design. As GAO reported in July 2013, the Navy later opted to fund additional ships without having completed this planned period of discovery and learning. Further, LCS 1 and LCS 2 have experienced major cost growth and schedule delays. In August 2010, GAO reported that the ships were incomplete at delivery and in November 2013, GAO reported on significant quality problems with Navy ships, including LCS 1 and LCS 2, noting that the Navy regularly accepts ships with numerous open deficiencies.

Congress mandated that GAO review the Navy's compliance with federal regulations in accepting LCS 1 and LCS 2. This report (1) assesses the extent to which the Navy complied with applicable federal regulations, policies, and contracts and (2) evaluates the basis for and outcomes from decisions to accept these ships. To conduct this work, GAO analyzed applicable federal regulations, policies, contracts, and program documentation, and spoke with relevant Department of Defense (DOD) and contractor officials.

## What GAO Recommends

Because the opportunity to implement acquisition changes to these two ships has passed, GAO is not making any new recommendations in this report, but has made prior recommendations to improve LCS acquisition. DOD has acted on some, but not all, of these.

View [GAO-14-827](#). For more information, contact Michele Mackin at (202) 512-4841 or [mackinm@gao.gov](mailto:mackinm@gao.gov).

## LITTORAL COMBAT SHIP

### Navy Complied with Regulations in Accepting Two Lead Ships, but Quality Problems Persisted after Delivery

## What GAO Found

Navy decisions to accept the first two littoral combat ships (LCS)—LCS 1 and LCS 2—in incomplete, deficient conditions complied with the Federal Acquisition Regulation's (FAR) acceptance provisions, largely due to the cost-reimbursement type contracts in place to construct these ships. The Navy also met FAR requirements related to responsibility for and place of acceptance, among other provisions, by using an authorized Navy representative to accept each ship at its respective contractor's facility. Under the cost-reimbursement contracts, the LCS 1 and LCS 2 prime contractors were only required to give their best efforts to complete quality-related activities—along with the other work specified in the contracts—up to each contract's estimated cost. These efforts resulted in both ships not completing all required sea trials—tests that evaluate ships' overall quality and performance against contractual requirements—including acceptance and final contract trials, as shown in the table below.

**Execution Status of Littoral Combat Ship (LCS) Quality-Related Contract Terms**

Contract terms	LCS 1	LCS 2
Complete acceptance trials	✓	☒
Ship systems in operating condition with no outstanding trial deficiencies at the time the Navy accepts delivery	☒	☒
Complete final contract trials	☒	☒

✓ Fully executed

☒ Incomplete

Source: GAO analysis of Navy documentation. | GAO-14-827

Not completing these trials increased knowledge gaps related to ship performance and deficiencies. In addition, LCS 1 and LCS 2 did not meet the quality standards outlined in the Navy's ship acceptance policy, although the policy also contains several notable flexibilities to these standards. In particular, the policy recognizes situations where the Navy may defer work until after delivery and final acceptances and affords the Chief of Naval Operations the authority to waive certain quality standards outlined in the policy. The Navy relied extensively on these waivers to facilitate its trials and acceptance processes for LCS 1 and LCS 2.

Navy decisions to accept delivery of LCS 1 and LCS 2 in incomplete, deficient conditions were driven by a focus on near-term cost performance by shipbuilders, a desire to introduce the long-delayed ships to the fleet, and—in the case of LCS 1—environmental and treaty considerations associated with constructing that ship adjacent to the Great Lakes. The Navy prioritized these factors over its quality assurance processes for both ships, which has caused it to devote considerably more time and money to resolving deficiencies after delivery than anticipated. However, because the Navy did not establish clear deadlines for resolving ship deficiencies, corrections were allowed to lag, to the point that fleet operators inherited unresolved deficiencies on each ship. These deficiencies have constrained recent shipboard operations.

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Abbreviations

AT	Acceptance Trials
BT	Builder’s Trials
DFARS	Department of Defense Federal Acquisition Regulation Supplement
DOD	Department of Defense
FAR	Federal Acquisition Regulation
INSURV	Navy Board of Inspection and Survey
LCS	Littoral Combat Ship
NAVSEA	Naval Sea Systems Command
OPNAVINST	Office of the Chief of Naval Operations Instruction
RDT&E	Research, Development, Test and Evaluation
SCN	Shipbuilding and Conversion, Navy
SUPSHIP	Navy Supervisor of Shipbuilding, Conversion, and Repair
TSM	Technical Support Management

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September 25, 2014

## Congressional Committees

The Navy's Littoral Combat Ship (LCS) is a program framed by an innovative approach to shipbuilding acquisition and naval operations. Unlike other Navy surface combatants, which generally have fixed mission systems, LCS is intended to be reconfigurable to perform three different primary missions: mine countermeasures, surface warfare, and anti-submarine warfare. The LCS consists of two distinct parts: (1) a seaframe, which is essentially the ship itself, and (2) a mission package, which is an interchangeable set of sensors, weapons, aircraft, surface craft, and subsurface vehicles carried on and deployed from the seaframe.

The LCS will represent a large portion of the Navy's future surface combatant fleet. Currently, the Navy plans to spend over \$25 billion (in 2010 dollars) to acquire 32 LCS seaframes—in two variants from two contractors—and 64 mission packages. The Navy had planned to acquire 52 seaframes but in February 2014, the Secretary of Defense directed the Navy to not contract for more than 32 ships, citing concerns about the ships' capabilities—including survivability and lethality. The Secretary directed the Navy to revisit the designs of both seaframe variants; that review is ongoing. To date, the Navy has accepted delivery of 4 seaframes—including the two lead ships, LCS 1 and LCS 2—and has contracted for 20 additional seaframes.

Federal and Department of Defense (DOD) regulations, policies, and contracts set forth certain criteria for the Navy's acceptance of goods and services—including ships—from contractors. In 2010, we found that the Navy had accepted delivery of LCS 1 and LCS 2 with both seaframes in an incomplete state and with outstanding technical issues.<sup>1</sup> In 2013, we found that several of these deficiencies continued to persist, and that certain trials normally carried out for new ships remained incomplete for the two lead ships. We also found that these ships had followed an unusual acceptance process, which the Navy program office attributed to

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<sup>1</sup>GAO, *Defense Acquisitions: Navy's Ability to Overcome Challenges Facing the Littoral Combat Ship Will Determine Eventual Capabilities*, [GAO-10-523](#) (Washington, D.C.: Aug. 31, 2010).

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the research, development, test, and evaluation funding used to construct them.<sup>2</sup> In light of its own concerns about these ships, Congress mandated in the National Defense Authorization Act for Fiscal Year 2013 that GAO conduct a review of the Navy's compliance with subpart 46.5 of the Federal Acquisition Regulation (FAR), which concerns government acceptance of contractor-provided supplies and services, and the corresponding subpart in DOD's FAR Supplement (DFARS) in accepting LCS 1 and LCS 2.<sup>3</sup> This report (1) assesses the extent to which the Navy complied with applicable federal regulations, contracts, and policies in accepting LCS 1 and LCS 2 and (2) evaluates the basis for and outcomes from the Navy's decision to accept delivery of these ships.

To assess the extent to which the Navy complied with applicable federal regulations, contracts, and policies, we identified ship acceptance requirements outlined in the FAR, DFARS, Navy policies, and the contracts for LCS 1 and LCS 2. We also analyzed DOD and Navy documentation, including acquisition strategies, trial schedules and reports, material inspection and receiving reports, deficiency waivers, and answers to questions posed to the Navy's Assistant General Counsel for Research, Development and Acquisition to identify how the Navy applied or waived these requirements in accepting LCS 1 and LCS 2 in deficient conditions. To evaluate the basis for and outcomes from the Navy's acceptance decisions, we analyzed Navy and contractor documents detailing LCS 1 and LCS 2 construction costs and schedules, testing plans, and deficiency correction plans. In addition, we analyzed Navy budget submissions and post-delivery work agreements to evaluate how and whether the Navy achieved the post-delivery cost efficiencies it anticipated when accepting LCS 1 and LCS 2. We obtained Navy data to determine the number and type of deficiencies for each vessel. We reviewed information about the data and the system that produced them, and determined that the data were sufficiently reliable for the purposes of this report for the ships we reviewed. We also reviewed fleet reports on equipment casualties to understand the extent to which persisting LCS 1 and LCS 2 deficiencies have affected recent operations. We supplemented each of the above steps by interviewing officials

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<sup>2</sup>GAO, *Navy Shipbuilding: Significant Investments in the Littoral Combat Ship Continue Amid Substantial Unknowns about Capabilities, Use, and Cost*, [GAO-13-530](#) (Washington, D.C.: July 22, 2013).

<sup>3</sup>Pub. L. No. 112-239, § 128(a).

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responsible for managing LCS contracts, construction, trials, and acceptances. A more detailed description of our scope and methodology is presented in appendix I.

We conducted this performance audit from November 2013 to September 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

LCS is designed to move fast and transport manned and unmanned mine countermeasures, surface warfare, and anti-submarine warfare systems into theater. For the LCS, the seaframe consists of the hull; command and control systems; automated launch, handling, and recovery systems; and certain core combat systems like an air defense radar and 57-millimeter gun. The Navy is embedding LCS's mine countermeasures, surface warfare, and anti-submarine warfare capabilities within mission packages. These packages—acquired separately from the seaframes—are comprised of unmanned underwater vehicles, unmanned surface vehicles, towed systems, and hull- and helicopter-mounted weapons.

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## Seaframe Acquisition

The Navy acquired the first two seaframes, LCS 1 and LCS 2, in two different designs from shipbuilding teams led by Lockheed Martin and General Dynamics. Lockheed Martin constructed LCS 1 at Marinette Marine, which is located in Marinette, Wisconsin, while General Dynamics constructed LCS 2 at Austal USA in Mobile, Alabama. In addition to LCS 1 and LCS 2, the Navy has also contracted for construction of an additional 22 ships, of which 2 (LCS 3 and LCS 4) have been delivered to date.<sup>4</sup> The two designs reflect different contractor solutions to the same set of performance requirements. The most notable difference is that the

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<sup>4</sup>Lockheed Martin was the prime contractor for LCS 3 and continues in that role for the other 10 odd-numbered seaframes (LCS 5 through 23) currently under contract. General Dynamics was the prime contractor for LCS 4—another Austal USA-built ship—but ended its teaming arrangement with Austal USA in 2010. Subsequently, Austal USA is the prime contractor for the other 10 even-numbered seaframes (LCS 6 through 24) that are currently under contract.



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Lockheed Martin version—referred to as the *Freedom* variant—is a monohull design with a steel hull and aluminum superstructure, while the General Dynamics/Austal USA version—known as the Independence variant—is an aluminum trimaran.

LCS was intended to be an affordable ship at \$220 million per seaframe. The Navy executed cost-reimbursement contracts with the shipbuilding teams for design of LCS 1 and LCS 2 in July 2003. Subsequently, the Navy exercised options under these contracts for the detail design and construction of LCS 1 and LCS 2—in December 2004 and October 2005—for \$188.2 million and \$223.2 million, respectively.<sup>5</sup> Cost-reimbursement contracts provide for payment of allowable incurred costs, to the extent prescribed in the contract, and establish an estimate of the total cost of the contract—referred to as the total estimated cost or ceiling cost.<sup>6</sup> This contract type places most of the risk on the government, which may pay more than budgeted should incurred costs be more than expected when the contract is signed, and can be appropriate for use on complex research and development projects when performance uncertainties or the likelihood of changes makes it difficult to estimate performance costs in advance. Under this contracting arrangement, the contractor agrees to use its best efforts to perform the work specified under the contract within the estimated cost. However, the government must reimburse the contractor for its allowable costs regardless of whether the contractor completes work on the particular item. The Navy contracted for the remaining seaframes currently under contract using fixed-price incentive contracts. Fixed-price incentive contracts place increased risk on the contractor, which generally bears some responsibility for increased costs of performance, including full responsibility once the contract's price ceiling is exceeded.<sup>7</sup>

The Navy's acquisition strategy for LCS seaframes has changed several times over the past decade. The original plan was to fund one or two initial ships—in what the Navy called a Flight 0 configuration—based on the designs it selected through a conceptual design competition, and then spend time experimenting with the seaframes and overall LCS concept.

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<sup>5</sup>The options for detail design and construction were awarded on a cost-plus-incentive-fee/cost-plus-award-fee basis.

<sup>6</sup>FAR § 16.301-1.

<sup>7</sup>FAR § 16.403.

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Further, the significant differences between the two seaframe designs lent even more importance to the experimentation concept to inform a decision about which seaframe design was better suited to meet the Navy's needs. After a down-select decision, the winning design was to be procured in larger numbers, with any design changes incorporated into a new Flight 1 configuration. The Navy abandoned this strategy, however, after concluding it would be unrealistic to expect the two competing shipyards to build only one or two ships and then wait for the Navy to complete the period of experimentation before awarding additional contracts.<sup>8</sup> Instead, the Navy opted to continue funding additional seaframes.

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## Ship Acceptance Requirements and Processes

Several federal and DOD regulations and Navy policies govern Navy ship acceptance processes. For LCS 1 and LCS 2, these regulations and policies include the following:

- **FAR part 46:** Prescribes policies and procedures to ensure that supplies (such as ships) and services acquired under a government contract conform to the contract's quality and quantity requirements, including provisions on inspection and acceptance. Under the terms of inspection clauses in government contracts, the government generally has the right to inspect and test supplies tendered under the contract before accepting the supplies.
- **FAR section 46.101** defines acceptance as the act of an authorized representative of the government by which the government assumes ownership of supplies tendered as partial or complete performance of the contract.
- **FAR subpart 46.5** prescribes specific regulations on acceptance. **Section 46.501** states, among other things, that acceptance constitutes acknowledgement that the supplies or services conform with applicable contract quality and quantity requirements except as provided in the subpart and subject to other terms and conditions of the contract. Other subpart 46.5 sections identify

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<sup>8</sup>[GAO-13-530](#).

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regulations related to responsibility for and place of acceptance, certificates of conformance, and transfer of title and risk of loss.<sup>9</sup>

- **DFARS subpart 246.5:** Identifies DOD regulations related to certificates of conformance, including use of a certificate of conformance for ship critical safety items.
- **Office of the Chief of Naval Operations Instruction (OPNAVINST) 4700.8H, *Trials, Acceptance, Commissioning, Fitting Out, Shakedown, and Post Shakedown Availability of U.S. Naval Ships Undergoing Construction or Conversion*** (Dec. 5, 1990).<sup>10</sup> This instruction outlines Navy policy, procedures, and responsibilities related to ship acceptances.

As is typical for all Navy ships, including LCS seaframes, after the shipbuilder is satisfied that the ship is complete, the ship embarks on a series of dockside and at-sea tests—known as **sea trials**—to evaluate overall quality and performance against the contractually required technical specifications and performance requirements. Navy shipbuilding programs, including LCS, generally conduct two sets of sea trials—builder’s trials and acceptance trials.

- During builder’s trials, inspectors from the Navy’s Supervisor of Shipbuilding, Conversion, and Repair (SUPSHIP) are generally responsible for observing and identifying deficiencies. SUPSHIP is the organization charged with administering and managing DOD contracts with commercial entities in the shipbuilding and ship repair industry.
- During acceptance trials, the responsibility for identifying deficiencies falls upon the Navy’s Board of Inspection and Survey (INSURV), an independent organization whose inspectors evaluate the newly constructed ship and report on its material condition to Congress and Navy leadership.

Ideally, following the successful completion of sea trials and once the government is satisfied that the ship meets requirements, the shipbuilder delivers the ship. Delivery is also referred to as **preliminary acceptance**

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<sup>9</sup>Certificates of conformance are documents that the government may use in lieu of government inspection where the contractor certifies that the quality of the supplies or services conform with contract requirements.

<sup>10</sup>In July 2012, following LCS 1 and LCS 2 acceptances, the Navy updated this instruction with a new version, OPNAVINST 4700.8J.

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of the ship. The Navy accepted delivery of LCS 1 and LCS 2 on September 18, 2008, and December 18, 2009, respectively. In Navy shipbuilding, the official transfer of custody occurs at preliminary acceptance when the Navy signs a Material Inspection and Receiving Report (Form DD 250).

Following preliminary acceptance, Navy ships undergo several additional activities to prepare them for service within the fleet. These activities, which can generally take up to a year to complete, include the following:

- **Guaranty period:** The guaranty period is a time specified in the contract during which the shipbuilder retains responsibility for correcting any defects that arise on the ship (other than normal wear and tear). The guaranty period is initiated once the Navy accepts delivery of the ship (i.e., once the Form DD 250 is signed). The LCS 1 and LCS 2 contracts each provided for 8-month guaranty periods.
- **Industrial post-delivery availability and/or post-delivery availability:** The Navy completes one or both of these availabilities following ship delivery to accomplish remaining work, including critical engineering changes identified late in the construction schedule that were not completed during ship construction. These changes are to address safety or mission critical issues or are essential to support post-delivery test and trials.
- **Final outfitting and post-delivery tests:** Following delivery and until sailaway from the shipbuilder's yard—usually anywhere from 10 to 90 days after the Navy accepts delivery—the crew boards the ship and begins training. Additional training and operational tests of mission systems occur at the ship's home port.
- **Final contract trials:** INSURV inspectors conduct a second round of sea trials to assess whether the ship and all mission equipment are operating as intended. Typically, these trials are held prior to expiration of the ship's guaranty period.
- **Final acceptance:** Upon expiration of any contractually specified guaranty period, final acceptance occurs. The Navy does not complete any documentation related to final acceptance of ships. For

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LCS 1 and LCS 2, final acceptances occurred in May 2009 and August 2010, respectively.<sup>11</sup>

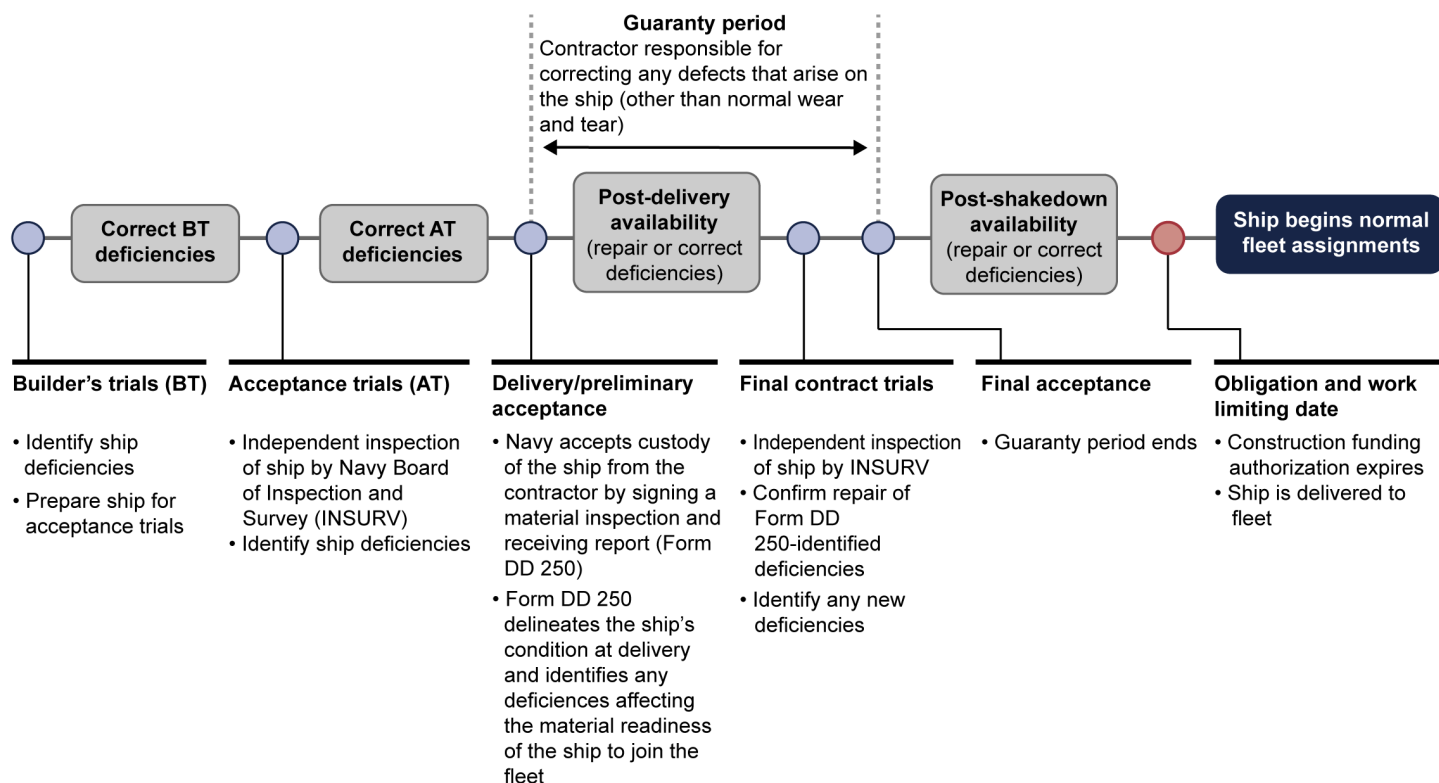
- **Post shakedown availability:** A period of planned maintenance follows final contract trials. During this time, class-wide upgrades and correction of new or previously identified deficiencies that are the government's responsibility also occur.
- **Obligation and work limiting date:** The official date on which full responsibility for funding the ship's operation and maintenance is transferred from the acquisition command to the operational fleet. The Navy is required to set an obligation and work limiting date for any ship it constructs using Shipbuilding and Conversion, Navy (SCN) appropriations. LCS 1 and LCS 2, however, are unique among Navy ships in that they were constructed using Research, Development, Test and Evaluation (RDT&E) appropriations, and pursuant to Navy guidance, there is no requirement for an obligation and work limiting date for ships constructed with RDT&E funds.

Figure 1 highlights how these different events are typically sequenced for Navy ships.

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<sup>11</sup>With respect to the Navy's acceptance of ships, the Navy's assistant general counsel for research, development and acquisition indicated that the FAR provision that "[a]cceptance constitutes acknowledgement that the supplies or services conform with applicable quality and quantity requirements..." pertains to final acceptance, rather than preliminary acceptance.

**Figure 1: Typical Ship Acceptance Process**



Source: GAO analysis of Navy documentation. | GAO-14-827

Quality deficiencies on Navy ships can be identified at all points throughout the shipbuilding process, during construction to sea trials and even after delivery. SUPSHIP oversees the construction process by inspecting and testing the shipbuilder's completed work and issuing requests for the shipbuilder to correct any identified deficiencies. During acceptance trials, INSURV inspectors label the most serious issues as "starred" deficiencies. These issues can significantly degrade a ship's ability to perform an assigned primary or secondary operational capability or the crew's ability to safely operate and maintain ship systems. Because of their importance, starred deficiencies must be corrected by the builder or waived by the Chief of Naval Operations prior to accepting delivery of the ship.

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We have previously reported extensively on risks and challenges confronting the Navy's acquisition of LCS seaframes. In particular, our reports have highlighted multiple issues surrounding the deliveries of LCS 1 and LCS 2:

- In August 2010, we found that the Navy accepted delivery of LCS 1 and LCS 2 in incomplete, deficient states. Most notably, shipbuilders had not demonstrated the launch, handling, and recovery systems—critical for deploying and retrieving mission package watercraft—on LCS 1 or LCS 2 ahead of those ships' deliveries and subsequent final acceptances.<sup>12</sup>
- In November 2013, we reported on quality shortfalls across Navy shipbuilding programs, including LCS. We found that LCS 1 and LCS 2 were delivered with a large number of open deficiencies, the majority of which were determined to be attributable to the contractors. Our analysis found that over half of these deficiencies were closed after the ships were delivered to the Navy and were being outfitted, but other deficiencies continued to be unresolved one year after delivery—a point at which the Navy had taken final acceptance of LCS 1 and LCS 2. We subsequently made several recommendations aimed at improving the construction quality of ships delivered to the Navy.<sup>13</sup>
- In July 2014, we reported on testing and weight management challenges facing LCS seaframes. We found that initial seaframes face capability limitations resulting from weight growth during construction, including LCS 1 and LCS 2 not meeting performance requirements for sprint speed and endurance, respectively.<sup>14</sup>

The Navy addressed some, but not all, of our recommendations in these different reports.

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<sup>12</sup>[GAO-10-523](#).

<sup>13</sup>GAO, *Navy Shipbuilding: Opportunities Exist to Improve Practices Affecting Quality*, [GAO-14-122](#) (Washington, D.C.: Nov. 19, 2013).

<sup>14</sup>GAO, *Littoral Combat Ship: Additional Testing and Improved Weight Management Needed Prior to Further Investments*, [GAO-14-749](#) (Washington, D.C.: July 30, 2014).

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## Navy Complied with FAR Acceptance Provisions and Took Full Advantage of Waivers to Accept Ships with Quality Deficiencies

The Navy complied with the relevant FAR provision in accepting LCS 1 and LCS 2 in incomplete, deficient conditions, largely due to the cost-reimbursement type contracts in place to construct these ships.<sup>15</sup> The Navy also met FAR requirements related to responsibility for and place of acceptance and transfer of title, among other provisions. Under the cost-reimbursement contracts, the LCS 1 and LCS 2 prime contractors were only required to give their best efforts to complete quality-related activities—along with the other work specified in the contracts—up to each contract’s estimated cost. These efforts resulted in LCS 1 and LCS 2 not completing final contract trials, and LCS 2 not finishing its acceptance trials—resulting in increased knowledge gaps related to ship performance and deficiencies. In addition, the Navy did not achieve the quality standards on LCS 1 and LCS 2 that are outlined in its own ship acceptance policy, although the policy also contains several notable flexibilities to these standards. In particular, the policy recognizes situations where the Navy may defer work until after delivery and final acceptances and affords the Chief of Naval Operations the power to waive certain quality standards outlined in the policy. The Navy relied extensively on these waivers to facilitate its trials and acceptance processes for LCS 1 and LCS 2.

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## Navy Acceptances of LCS 1 and LCS 2 Complied with FAR Acceptance Provisions, Largely Because of Contract Type

Although LCS 1 and LCS 2 contained numerous deficiencies—including areas of the ships that remained incomplete when the Navy took final acceptance—the Navy’s actions complied with section 46.501 of the FAR because these actions were consistent with the cost-reimbursement terms of the respective contracts.<sup>16</sup> Under cost-reimbursement type contracts, the government generally reimburses the contractor for the costs it incurs in performing the contract. Specifically, cost-reimbursement contracts such as the LCS 1 and LCS 2 contracts include a “limitation of cost” or “limitation of funds” clause, which provides an estimated cost

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<sup>15</sup>Detail design and construction of LCS 1 and LCS 2 was awarded on a cost-plus-incentive-fee/cost-plus-award-fee basis.

<sup>16</sup>Although section 46.501 of the FAR states, in relevant part, that acceptance constitutes acknowledgment that the supplies conform with contract quality requirements, the provision also recognizes that acceptance shall be “subject to other terms and conditions of the contract.” Thus, the Navy’s actions in accepting LCS 1 and LCS 2 must be considered in light of the terms and conditions of the specific cost-reimbursement contracts for these ships.



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(also known as the ceiling cost) for performance of the contract.<sup>17</sup> These clauses state that the government is not obligated to reimburse the contractor for costs incurred in excess of the estimated cost, and the contractor is not obligated to continue performance or otherwise incur costs in excess of the estimated cost.<sup>18</sup> For ships, including LCS 1 and LCS 2, the limitation of cost or funds clause applies through the end of the guaranty period, which culminates in final acceptance.

According to the Navy's assistant general counsel for research, development and acquisition, at the point when the Navy was to take final acceptance of LCS 1 and LCS 2, each ship's contractor had incurred costs that were close to the respective total estimated cost (ceiling cost) of the contract. Pursuant to the limitation of cost clause in each of the contracts, the LCS contractors were not obligated to repair or replace non-conforming work or otherwise incur costs in excess of the total estimated contract cost, regardless of whether the ships failed to meet quality standards or were otherwise incomplete at the point when the Navy accepted the ships. Once the contractors had incurred costs equal to the respective total estimated costs, the Navy faced the choice of either increasing total estimated costs to permit the respective contractors to continue work or proceeding with final acceptances of the ships in their deficient conditions. For LCS 1 and LCS 2, the Navy took the second approach.

The Navy also complied with the other requirements of FAR subpart 46.5 and DFARS subpart 246.5 regarding the government's acceptance of supplies or services. In particular, each ship was accepted by an authorized SUPSHIP representative at the respective contractor's facility as specified in the contracts, and the Navy did not need to employ any certificates of conformance for either LCS 1 or LCS 2. In addition, FAR subpart 46.5 contains a provision on transfer of title and risk of loss. The Navy's ship acceptance process—including the transfer of custody by signing the Material Inspection and Receiving Report—and the passage

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<sup>17</sup>FAR § 32.706-2.

<sup>18</sup>FAR §§ 52.232-20; 52.232-22. GAO discusses issues associated with limitation of cost and limitation of funds clauses, and operation of the contract cost ceiling, in *National Aeronautics and Space Administration—Constellation Program and Appropriations Restrictions, Part II*, B-320091, July 23, 2010 and *Office of Management and Budget Guidance on the Worker Adjustment and Retraining Notification (WARN) Act*, B-324146, Sept. 12, 2013.

of title to a ship are separate processes, and no specific document transfers title of a ship to the Navy. There was no specific point in time when titles to LCS 1 and LCS 2 as a whole were transferred to the Navy. Passage of titles to these ships complied with the applicable federal regulation and was governed by a specific contract clause on government property, providing for title to property to pass to the Navy as the ships were constructed.

Key Contract Terms  
Related to Quality  
Were Not Exercised

The cost-reimbursement contracts for LCS 1 and LCS 2 contain several quality-related terms intended to facilitate delivery of seaframes that were complete, tested, and free of deficiencies. However, under these contracts, the LCS 1 and LCS 2 prime contractors were only required to give their best efforts to complete the specified work up to each contract’s estimated cost. These efforts limited the extent to which quality-related terms of the ships’ contracts were exercised. Table 1 provides an overview of these quality-related contract terms and identifies whether they were fully executed for LCS 1 and LCS 2.

Table 1: Execution Status of LCS 1 and LCS 2 Quality-Related Contract Terms

	LCS 1	LCS 2
Contract terms		
Complete builder’s trials	✓	✓
Correction of contractor-responsible deficiencies prior to and following builder’s trials	☒	☒
Complete preliminary acceptance trials	✓	☒
Correction of contractor-responsible deficiencies discovered before, during, or after completion of acceptance trials	☒	☒
Deliver vessel for preliminary acceptance following satisfactory completion of acceptance trials and correction of contractor-responsible deficiencies	☒	☒
Ship systems shall be in operating condition with no outstanding trial deficiencies at the time the Navy accepts delivery (preliminary acceptance)	☒	☒
Guaranty period beginning at preliminary acceptance and ending after 8 months	✓	✓
Complete final contract trials	☒	☒

- ✓ Fully executed
- ☒ Incomplete

Source: GAO analysis of Navy documentation. | GAO-14-827

Most notably, the Navy did not conduct final contract trials for LCS 1 or LCS 2. Normally, sea trials—including final contract trials—require 4 to 5 days to complete and are graded evaluations by INSURV, which identify

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whether the ship's material condition is satisfactory, degraded, or unsatisfactory. Alternatively, for LCS 1, the Navy completed an abbreviated 2-day special trial in May 2012, which was ungraded by INSURV and showed both residual and new deficiencies. Final contract trials are intended to provide important information on ship performance toward the end of the guaranty period. Special trials are not intended to substitute for the more rigorous final contract trials.

LCS 2, on the other hand, has never even completed its acceptance trials. Prior to delivery in 2009, the Navy decided to split the acceptance trials for LCS 2 into two parts because the ship was incomplete and unfinished when initial acceptance trials got underway. The second, remaining portion of the acceptance trials—intended to demonstrate several of the ship's untested combat systems—was scheduled for completion in summer 2010. However, the Navy subsequently never held these trials and, in August 2014, completed a 1-day ungraded special trial for LCS 2—approximately 4 years after it took final acceptance of the ship.

The Navy's decision to not complete key LCS 1 and LCS 2 trials is inconsistent with the program office's earlier plans and agreements with INSURV—the Navy organization responsible for conducting trials. The LCS program office initially planned to hold two separate sets of acceptance trials for both LCS 1 and LCS 2. However, aside from splitting each ship's acceptance trials, INSURV officials stated that LCS 1 and LCS 2 were otherwise expected to follow the normal trials and acceptance process. Yet, in light of the program office's later decision to not make LCS 2 available for its second set of planned acceptance trials, INSURV officials told us they were unlikely to agree to conduct trials on future ships in a similar manner. INSURV officials did note, however, that they recognize that *Freedom* variant ships built at Marinette Marine face environmental and treaty limitations that compel the need for two sets of acceptance trials, although the scope of testing that has to be deferred from the Great Lakes is—and should continue to be—minimal.

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## Navy Acceptance Decisions Took Full Advantage of Waivers Allowed under Policy to Circumvent Guidelines for Delivering Defect- Free Ships

Navy policy requires robust standards to be met prior to a ship's delivery and continuing through the end of the guaranty period—standards that LCS 1 and LCS 2 did not meet.<sup>19</sup> Key quality standards contained in this policy include the following:

- Ships and submarines will be fully mission capable, in the sense that all contractual and governmental responsibilities shall be resolved prior to the Navy accepting delivery (preliminary acceptance), except for crew certification, outfitting, or special Navy range requirements which cannot be met until after delivery.
- Delivery of the ship is based on acceptance trials and satisfactory correction or resolution of deficiencies, and acceptance trials shall be conducted when all work, including the correction of significant known deficiencies, has been completed.
- Final contract trials are to be conducted at sea and should have operations at full power and be of sufficient thoroughness to determine whether defects have developed since acceptance trials.

However, the policy also provides certain flexibilities that allow the Navy to conduct sea trials for and accept delivery of a ship with deficiencies. These flexibilities enabled the Navy to defer certain work on LCS 1 and LCS 2 until after preliminary and final acceptances. Most notably, the policy allows for the following:

- Deferring work until the post-delivery period before the vessel is transferred to the fleet, if determined to be prudent—for example, because of financial or workload reasons.
- In cases of new construction efforts, leaving significant ship systems/capabilities incomplete until the end of post shakedown availability.

Finally, the policy also provides for waiver requests, to be used in extraordinary circumstances, to the Chief of Naval Operations to provide for deviation from the policy. To facilitate the LCS 1 and LCS 2 acceptance processes, the program office obtained waivers for several

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<sup>19</sup>See OPNAVINST 4700.8H, *Trials, Acceptance, Commissioning, Fitting Out, Shakedown, and Post Shakedown Availability of U.S. Naval Ships Undergoing Construction or Conversion* (Dec. 5, 1990), which was in effect at LCS 1 and LCS 2 deliveries and final acceptances.

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provisions of the policy, which permitted the Navy to undertake the following activities on LCS 1 and LCS 2:

- Conduct acceptance trials with significant construction deficiencies.
- Accept delivery of the ships with uncorrected starred deficiencies.

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## Navy Decisions to Accept Ships in Deficient Condition Driven by Cost and Fleet Needs, and Quality Problems Persist

Navy decisions to accept delivery of LCS 1 and LCS 2 in incomplete, deficient conditions were driven by a focus on near-term cost performance by shipbuilders, a desire to introduce the long-delayed ships to the fleet, and—in the case of LCS 1—environmental and treaty considerations associated with the location of that ship’s construction. In prioritizing these factors, the Navy shortchanged its quality assurance processes for both ships, which has caused it to devote considerably more time and money to resolving deficiencies post-delivery than anticipated. However, because the Navy did not establish clear deadlines for resolving ship deficiencies, corrections were allowed to lag, to the point that fleet operators inherited unresolved starred deficiencies on each seaframe. Further, these deficiencies have constrained recent shipboard operations.

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## Navy Rationale for Accepting Deficient Ships Driven by Cost and Fleet Needs

Key factors that motivated the Navy to accept delivery LCS 1 and LCS 2 in incomplete, deficient conditions include (1) a desire to improve the contractors’ cost performance and (2) prioritization of fleet introduction, so as to begin experimenting with the ships and demonstrating operational and sustainment concepts. In addition, environmental limitations related to testing and transport compelled the Navy’s acceptance schedule for LCS 1. However, in most cases the outcomes of the Navy’s decisions were not as initially intended.

### Desire to Improve Cost Performance

In the final months leading up to the eventual deliveries of LCS 1 and LCS 2, the prime contractors consistently increased their cost estimates for completing the ships. For LCS 1 and LCS 2, contractor cost estimates increased 3.6 percent and 9.8 percent, respectively, in the 5 months preceding those ships’ deliveries. These increases were in addition to cost growth totaling over 150 percent that the Navy had previously incurred on each contract. According to LCS seaframe program officials, the LCS shipbuilders did not have strong incentives to complete the ships and deliver them to the Navy, in part because of the cost-reimbursement contracts that were in place. Consequently, the Navy pushed the delivery

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process forward for the ships—despite incomplete work and deficiencies—once the ships met minimal safe-to-sail conditions.<sup>20</sup>

According to LCS seaframe program officials, the program was confident that lower pricing for remaining work could be obtained after delivery by using different shipyards than Marinette Marine and Austal USA, where LCS construction took place. However, the Navy may not have achieved these anticipated cost benefits. Most notably, the Navy did not assess whether the eventual post-delivery shipyards—including Colonna's Shipyard (Norfolk, Virginia), BAE Systems Ship Repair (San Diego, California and Norfolk, Virginia), and General Dynamics NASSCO (San Diego, California)—would provide better pricing than the original construction yards. Instead, SUPSHIP officials reported that the Navy only completed assessments as to whether the eventual post delivery shipyards' pricing was fair and reasonable as compared to other shipyards in their own respective geographic areas. These geographic areas did not include Wisconsin or Alabama, where Marinette Marine and Austal USA—the original LCS construction yards—are located, respectively.

The cost-reimbursement type contracts used to construct LCS 1 and LCS 2 included both incentive and award fees to incentivize contractor performance. The incentive fee was designed to reward the contractor for controlling contract costs by increasing the fee when the costs incurred during contract performance were less than the contract's target cost. Work performed after delivery during the guaranty period, such as correction of deficiencies, was reimbursable without fee to the contractor.<sup>21</sup> For completion of the work remaining on both ships after the end of the guaranty period, including deficiency corrections and emergent work, the Navy instead created new arrangements, called basic ordering

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<sup>20</sup>INSURV defines a ship as safe to sail provided that, prior to sea trials, key ship systems and equipment are operational. These systems and equipment include control systems, navigation systems and lights, surface search radar, bridge radios, damage control equipment, anchor, lifeboat, and whistles. Further, INSURV requires that a minimum number of engines and generators be operational in order for the ship to be declared safe to sail.

<sup>21</sup>Each contract's limit of cost clause also applied through the end of the guaranty period.

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## Prioritization of Fleet Introduction

agreements, with the two LCS prime contractors.<sup>22</sup> These agreements anticipated placement of orders on a cost-plus-fixed-fee, cost-plus-award-fee, or fixed price basis. Most of the orders we reviewed were placed on a cost-plus-fixed-fee basis, where the contractor is reimbursed for its allowable incurred costs to the extent prescribed in the contract, and receives a fee that is fixed at the outset. These new agreements allowed Navy program officials to reprioritize work based on available funding and the ships' testing schedules. However, in contrast to the incentive fees used under the original construction contracts, cost-plus-fixed-fee contracts provide the contractor only a minimum incentive to control costs, and expose the government to increased cost risk.<sup>23</sup> As the Navy did not conduct a robust analysis of pricing for post delivery work among alternative shipyards—including the original LCS construction yards—and the contract structure used for post delivery work did not provide the contractors with incentives to control costs, it is unclear whether LCS 1 and LCS 2 cost performance improved or deteriorated as compared to previous performance within the original construction shipyards and under the original contract structure.

As we previously found in 2010, LCS 1 and LCS 2 experienced significant delivery delays—20 months and 26 months, respectively—as compared to their initial planned delivery dates.<sup>24</sup> These delays occurred in an environment where senior Navy leaders placed a high priority on introducing the ships to the fleet with haste in order to begin experimenting with and demonstrating LCS operational and sustainment concepts, which would help inform design changes to later ships in the class. Most notably, the program's 2004 acquisition strategy included a directive from the Chief of Naval Operations to "get the hulls into the water with the speed of heat."

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<sup>22</sup>Emergent work is defined as work recognized as necessary once parts of the ship are dismantled to allow inspection of normally hidden systems and when systems are tested in the yard. A basic ordering agreement is an agreement, not a contract, which establishes a mechanism to award future contracts (orders) between the parties during its term. A basic ordering agreement may be used to expedite contracting for uncertain requirements for supplies or services when specific items, quantities, and prices are not known at the time the agreement is executed, but a substantial number of requirements for the type of supplies or services covered by the agreement are anticipated to be purchased from the contractor. See FAR § 16.703.

<sup>23</sup>FAR § 16.306(a).

<sup>24</sup>[GAO-10-523](#).

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## Environmental and Treaty Limitations

The Navy's decision to accept delivery of LCS 1 without fully correcting starred deficiencies contributed to that ship's availability to complete a limited deployment in 2010 nearly 2 years ahead of plan, albeit with significant mission constraints. This deployment positioned the Navy to begin developing a life-cycle maintenance strategy for critical equipment on the *Freedom* variant. In July 2014, we identified operational lessons learned as part of the ship's 2013 deployment to Singapore, including equipment reliability and crew maintenance practices.<sup>25</sup> With LCS 2, although the Navy also accepted delivery before correcting starred deficiencies, opportunities to capitalize on this ship's availability for fleet use have been more constrained. As we previously found in 2013, the combat management system software on that ship was incomplete at delivery, and as of December 2012—3 years after ship delivery—questions remained among the LCS 2 crew about both the combat management system and radar. Most significantly, the crew had obtained minimal operational experience with both systems, and integration of weapon and sensor capabilities into the combat system remained incomplete.<sup>26</sup> Even as of August 2014, the combat management system continued to face significant limitations, which has restricted its use during fleet operations.

Navy officials reported that for LCS 1, environmental and treaty constraints also contributed to its delivery acceptance decision for that ship. These officials stated that the treaty constraints prevented the testing of certain ship systems, including weapon systems, during acceptance trials in the Great Lakes. Further, the ship's September 2008 delivery was timed, in part, to facilitate transiting the ship out of the Great Lakes and into the Atlantic Ocean before the St. Lawrence Seaway closed for the winter due to ice. These environmental and treaty limitations caused the Navy to split acceptance trials for LCS 1 into two parts—one within the Great Lakes, and a second trial in the Atlantic Ocean.<sup>27</sup> However, the scope of testing deferred into LCS 1's second acceptance trial included items that the Navy could have tested while in

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<sup>25</sup>GAO, *Littoral Combat Ship: Deployment of USS Freedom Revealed Risks in Implementing Operational Concepts and Uncertain Costs*, [GAO-14-447](#) (Washington, D.C.: July 8, 2014).

<sup>26</sup>[GAO-13-530](#).

<sup>27</sup>The Navy also split the acceptance trials for LCS 3 and plans to continue this practice for all *Freedom* variant seaframes constructed at Marinette Marine.



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the Great Lakes, but was prevented from doing so because of incomplete and deficient work. These items include the 11-meter rigid-hull inflatable boat and recovery winch, electrical load shedding and distribution systems, and splitter gears, among others.

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**Decisions to Accept Incomplete and Deficient Seaframes Have Produced Subpar Post-Delivery Outcomes**

When the Navy accepted delivery of LCS 1 and LCS 2, it anticipated significantly less time and money would be required to address quality problems than has actually been required. Instead, the aftermath of delivery for each of these ships has been characterized by significant cost growth, schedule delays, and the transfer of deficient ships to operational communities.

**Additional Deficiencies Identified Following Deliveries**

In 2013, we found that the Navy accepted delivery of LCS 1 and LCS 2 with unresolved starred deficiencies affecting both ships.<sup>28</sup> The Navy also deferred testing and certifications of numerous other ship systems and pieces of equipment as part of initial acceptance trials for these ships. Therefore, the Navy chose to accept delivery of both LCS 1 and LCS 2 without the benefit of a complete INSURV inspection to identify all deficiencies. Subsequent trials held after the delivery of LCS 1 identified additional deficiencies. LCS 2 has not yet been made available for a complete inspection by INSURV. Further, the Navy executed the first part of LCS 2's acceptance trials despite a considerable amount of incomplete work remaining throughout ship compartments. Comparatively fewer compartments were incomplete on LCS 1 for that ship's initial acceptance trials, but these incomplete areas included engine machinery spaces critical for demonstrating ship capabilities. Table 2 details LCS 1 and LCS 2 trial events and the key quality metrics identified at each event.

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<sup>28</sup> [GAO-14-122](#).

**Table 2: Overview of LCS 1 and LCS 2 Trials and Key Quality Metrics**

Ship	Trial event	Trial date	Number of new, starred deficiencies identified	Number of uninspected, undemonstrated systems	Number of incomplete certifications	Percentage of incomplete compartments
LCS 1	Acceptance trials (part one)	August 2008	21	63	19	2%
	Acceptance trials (part two)	May 2009	31	Not assessed	Not assessed	Not assessed
	Special trials	May 2012	Not assessed	Not assessed	Not assessed	Not assessed
LCS 2	Acceptance trials (part one)	November 2009	39	83	12	31%
	Special trials	August 2014	Not assessed	Not assessed	Not assessed	Not assessed

Source: GAO analysis of Navy documentation. | GAO-14-827

Notes: LCS 2 never held acceptance trials (part two). Although the Navy's Board of Inspection and Survey (INSURV) assessed deficiencies during special trials for LCS, INSURV officials stated that they did not identify new, starred deficiencies because the ships had already been accepted.

On both LCS 1 and LCS 2, the Navy deferred testing of systems, including key weapons systems such as the 57-millimeter gun, until after the ships' first set of acceptance trials. Further, mission package equipment—critical to LCS mission execution—was not tested as a part of either ship's acceptance trials. Consequently, key interfaces between the seaframes and mission package equipment—particularly, seaframe launch, handling, and recovery systems—remained undemonstrated at initial acceptance trials. Further, neither ship had acquired required third-party certifications for certain navigation, aviation, and tactical data link systems. Consequently, the Navy was not able to fully demonstrate the uncertified systems prior to delivery.

As LCS 1 trials events progressed, INSURV was able to inspect and demonstrate systems and equipment that were not available during that ship's first set of acceptance trials. These inspections and demonstrations resulted in additional starred deficiencies for the ship, in some cases, but also increased the Navy's knowledge related to the ship's capabilities. To date, however, INSURV has not completed similar follow-on inspections and demonstrations for LCS 2 systems and equipment. August 2014 special trials tested only four of the systems that the Navy excluded from inspection—or that failed inspection—during that ship's initial acceptance trials.

Post-Delivery and Outfitting Costs Have Grown to Address Deficiency Corrections and Complete Construction

The Navy has relied on RDT&E funds budgeted for post-delivery and outfitting activities to remedy LCS 1 and LCS 2 deficiencies and complete construction of these ships. As the Navy has identified additional LCS 1 and LCS 2 deficiencies following delivery of those ships, post-delivery and outfitting funding obligations to address the deficiencies have grown. Tables 3 and 4 below highlight the significant cost growth that the LCS 1 and LCS 2 post-delivery and outfitting accounts have incurred in the years since those ships delivered.

**Table 3: LCS 1 Cost Growth Since Delivery within Construction and Outfitting and Post-Delivery Budgets**

Dollars in millions

	Total cost in fiscal year 2009 budget	Total cost in fiscal year 2015 budget	Total cost growth	Cost growth as a percent of fiscal year 2009 budget
Basic construction	\$471.0	\$521.0	\$50.0	10.6%
Outfitting and post-delivery	\$75.0	\$120.3	\$45.3	60.4%
Additional costs <sup>a</sup>	\$85.0	\$41.0	-\$44.0	-51.8%
<b>Total</b>	<b>\$631.0</b>	<b>\$682.3</b>	<b>\$51.3</b>	<b>8.1%</b>

Source: GAO analysis of Navy budget documentation. | GAO-14-827

<sup>a</sup>Includes change orders, other costs, government-furnished equipment, and costs associated with final system design and the mission systems and ship integration team.

**Table 4: LCS 2 Cost Growth Since Delivery within Construction and Outfitting and Post-Delivery Budgets**

Dollars in millions

	Total cost in fiscal year 2010 budget	Total cost in fiscal year 2015 budget	Total cost growth	Cost growth as a percent of fiscal year 2010 budget
Basic construction	\$557.0	\$635.0	\$78.0	14.0%
Outfitting and post-delivery	\$75.0	\$145.6	\$70.6	94.1%
Additional costs <sup>a</sup>	\$72.0	\$72.0	\$0.0	0.0%
<b>Total</b>	<b>\$704.0</b>	<b>\$852.6</b>	<b>\$148.6</b>	<b>21.1%</b>

Source: GAO analysis of Navy budget documentation. | GAO-14-827

<sup>a</sup>Includes change orders, other costs, government-furnished equipment, and costs associated with final system design and the mission systems and ship integration team.

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Although the Navy identifies LCS 1 and LCS 2 outfitting and post-delivery funds within its RDT&E construction budget, it does not include these funds when calculating the total construction costs. Instead, Navy budget documents separate out funding for post-delivery and outfitting activities as “non-end cost” items for LCS 1 and LCS 2—a practice that obscures the true construction costs of these ships.<sup>29</sup>

The Navy has obligated some portion of LCS 1 and LCS 2 post-delivery and outfitting funds to activities other than completion of ship construction and correction of deficiencies. For instance, the Navy has funded activities such as emergent work and addition of crew amenities. However, seaframe program officials stated that these outfitting activities for the two hulls were minimal, and they were unable to further clarify these totals for us.

#### Fleet Ready Dates Delayed by Need to Correct Deficiencies

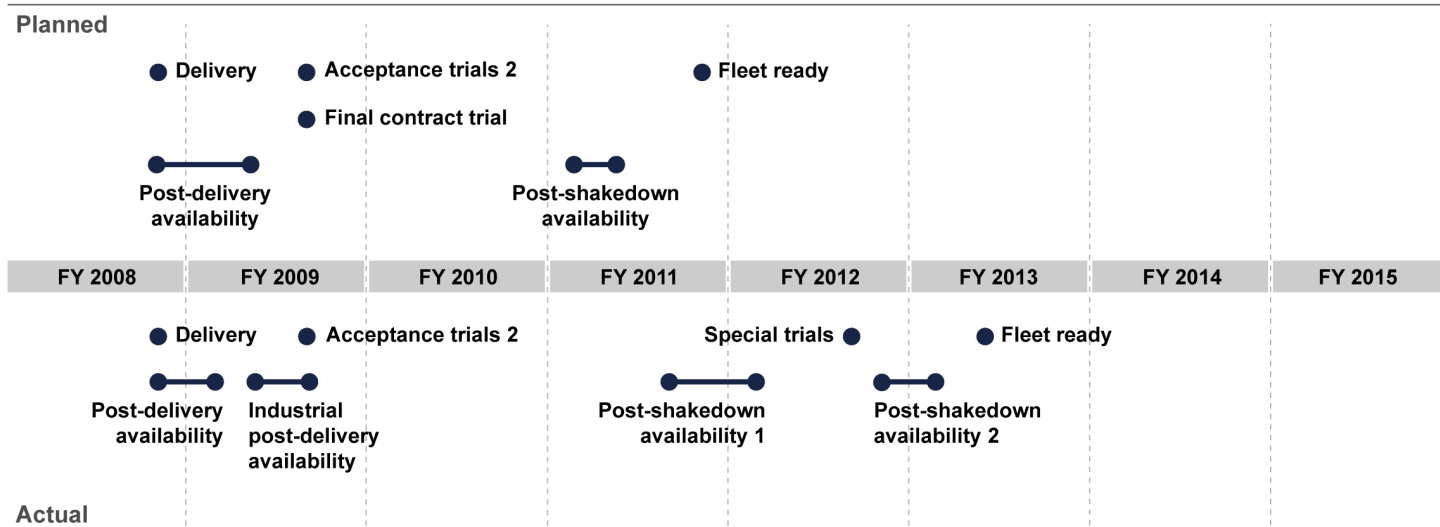
Obligation and work limiting dates establish deadlines that drive the acquisition community to do its part to bring a ship up to required specifications ahead of turning it over to the fleet. For an SCN funded ship, the obligation and work limiting date is set for 11 months following completion of outfitting for the ship. However, because the Navy constructed LCS 1 and LCS 2 using RDT&E appropriations, it was not required to set obligation and work limiting dates for these ships, and identification and correction of deficiencies was allowed to lag beyond normal timelines for Navy ships. In addition, post-delivery work periods—aimed at correcting LCS 1 and LCS 2 deficiencies—consumed more time than the Navy anticipated when it accepted delivery. Because deficiencies were not corrected in a timely manner, the ships were delayed in becoming fleet ready, or capable of executing required mission sets. These delays totaled approximately 1.5 years for LCS 1 and 6 months for LCS 2—although incomplete trials for LCS 2 call into question the Navy’s basis for declaring that ship as fleet ready.

Figures 2 and 3 highlight the effect of unanticipated extensions to LCS 1 and LCS 2 post-delivery work periods and delays achieving fleet readiness following delivery of those ships to the Navy.

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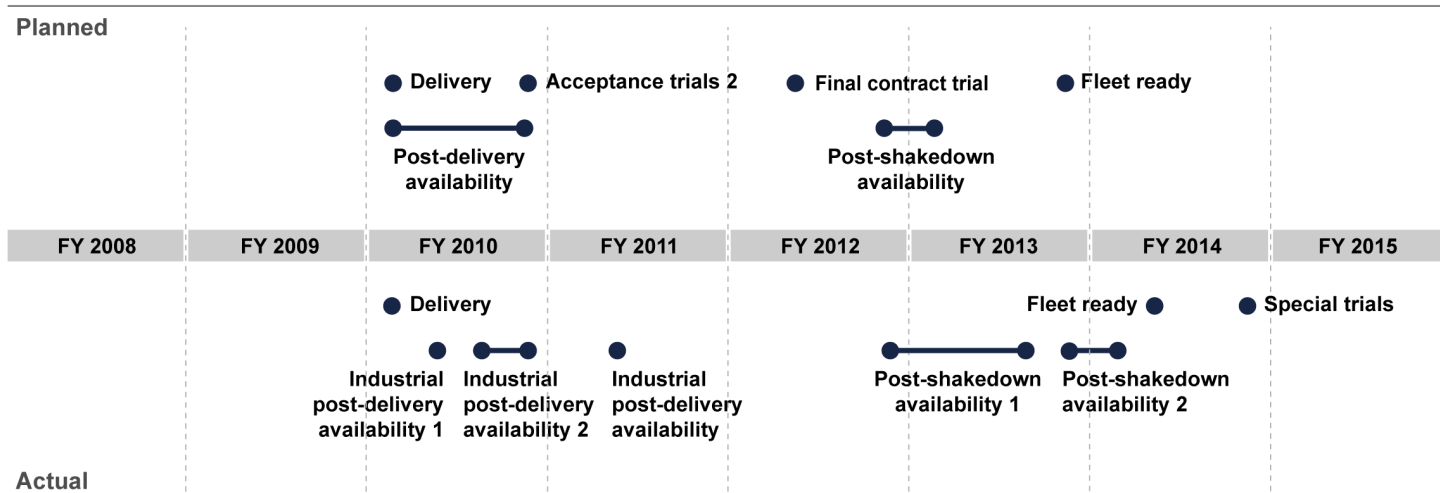
<sup>29</sup>The Navy also considers costs associated with final system design and the mission systems and ship integration team as non-end cost items for LCS 1 and LCS 2.

**Figure 2: Delays to Littoral Combat Ship 1 Deficiency Correction Activities Since Delivery**



Source: GAO analysis of Navy documentation. | GAO-14-827

**Figure 3: Delays to Littoral Combat Ship 2 Deficiency Correction Activities Since Delivery**

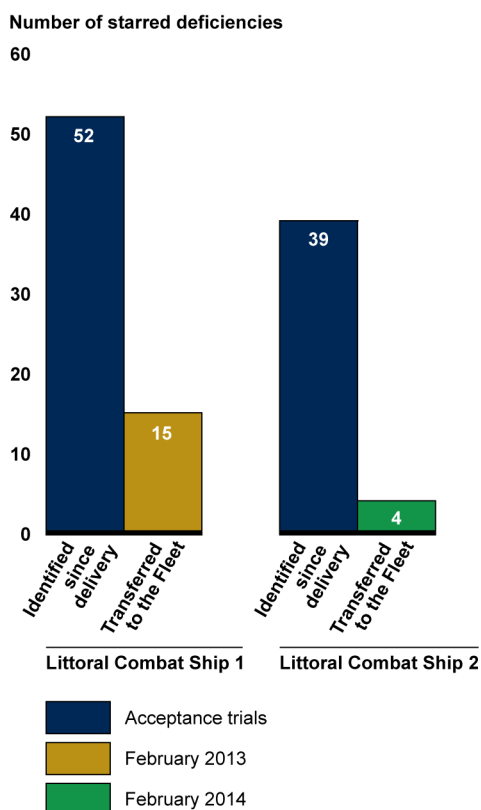


Source: GAO analysis of Navy documentation. | GAO-14-827

## Transfer of Seaframes to the Fleet in Deficient Condition

Although significant increases in funding and time devoted to post-delivery work have occurred, the program office did not fully resolve LCS 1 and LCS 2 starred deficiencies before it judged the ships as fleet ready. Once a ship is judged fleet ready—and subsequently transferred to the fleet for operations—responsibility for funding and scheduling correction of any remaining deficiencies shifts from the acquisition program office to the operational community. Figure 4 illustrates the number of starred deficiencies transferred from the program office to the fleet for both LCS 1 and LCS 2.

**Figure 4: LCS 1 and LCS 2 Starred Deficiencies Transferred from the Program Office to the Fleet**



Source: GAO analysis of Navy data and documentation. | GAO-14-827

Note: LCS 2 starred deficiencies only reflect discoveries from part one of that ship's acceptance trials. The Navy deferred demonstrations of several mission-critical ship systems—most notably, the ship's combat system—to a planned second set of acceptance trials, which the Navy subsequently never completed.

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When a ship is transferred to the fleet with uncorrected deficiencies, the fleet determines whether to fund repair of the deficiencies—using Operations and Maintenance, Navy appropriations—or to simply document the deficiencies as part of the ship’s material history. For LCS 1 and LCS 2, program officials reported that the fleet has elected to correct some deficiencies while leaving others uncorrected.

However, these uncorrected deficiencies have constrained recent shipboard operations. For example, during LCS 1 acceptance trials in 2008 and 2009, the Navy deferred testing of the ship’s launch, handling, and recovery system. Following these deferrals, fleet operators reported problems with system components—including, in 2013, the hoist motor and brake—indicating that the system was not performing adequately, and subsequently constraining mission readiness. On LCS 2, persisting deficiencies with the ship’s combat systems software have imposed operational limitations that constrain the ship’s ability to employ its 57-millimeter gun. Further, INSURV documented that the Fire Scout vertical take-off and landing tactical unmanned aerial vehicle remains untested by INSURV on both seaframes. According to seaframe program officials, the Navy’s inventory of these vehicles is overloaded with real world tasking, and none have been made available to the LCS program for testing or demonstration.

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## Concluding Observations

The Navy complied with FAR requirements in accepting LCS 1 and LCS 2, largely due to its use of cost-reimbursement contracts for these ships. At the same time, however, this contract type allowed some quality requirements to go unexecuted. Further, program officials did not establish obligation and work limiting dates for LCS 1 and LCS 2—unrequired because research and development appropriations funded these ships’ constructions—which allowed the Navy to deviate from disciplined and timely trials processes that it relies upon to expose deficiencies and prove out corrective fixes. The Navy’s priority was to accelerate the ships’ entry into the fleet. This accelerated schedule, however, spurred a need for extensive and costly post-delivery maintenance periods to correct deficiencies. Ultimately, the ships’ contributions to fleet activities were delayed and constrained.

Because our review was focused exclusively on LCS 1 and LCS 2, which the Navy accepted delivery of several years ago and has since transferred to the fleet, the opportunity to implement changes to the acquisition of these two ships has passed. In addition, the Navy is acquiring the remaining LCS seaframes under fixed-price incentive type

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contracts. Consequently, we are not making recommendations in this report.

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## Agency Comments and Our Evaluation

We provided a draft of this report to DOD for comment. In its written comments, which are reprinted in appendix II, DOD acknowledged receipt of the draft report. DOD also provided technical comments that we incorporated into the report, as appropriate.

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We are sending copies of this report to interested congressional committees, the Secretary of Defense, and the Secretary of the Navy. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or [mackinm@gao.gov](mailto:mackinm@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report.



Michele Mackin  
Director  
Acquisition and Sourcing Management



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Subcommittee on Defense  
House of Representatives

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# Appendix I: Scope and Methodology

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This report evaluates the Navy's acquisition of the first two Littoral Combat Ships (LCS). Specifically, we (1) assessed the extent to which the Navy complied with applicable federal regulations, contracts, and policies in accepting LCS 1 and LCS 2 and (2) evaluated the basis for and outcomes from the Navy's decision to accept delivery of these ships.

To assess the extent to which the Navy complied with applicable federal regulations, contracts, and policies in accepting LCS 1 and LCS 2, we identified ship acceptance requirements outlined in the Federal Acquisition Regulation (FAR), including part 46; Department of Defense's (DOD) FAR Supplement (DFARS), including subpart 246.5;<sup>1</sup> Navy policies, including Office of the Chief of Naval Operations Instruction (OPNAVINST) 4700.8H, *Trials, Acceptance, Commissioning, Fitting Out, Shakedown, and Post Shakedown Availability of U.S. Naval Ships Undergoing Construction or Conversion* (Dec. 5, 1990);<sup>2</sup> and the LCS 1 and LCS 2 contracts. We identified the Navy's acceptance process for LCS 1 and LCS 2 by reviewing program acquisition strategies, trial schedules and reports, material inspection and receiving reports, deficiency waivers from the Chief of Naval Operations, and monthly Navy Supervisor of Shipbuilding, Conversion, and Repair (SUPSHIP) briefings. We compared the Navy's LCS 1 and LCS 2 acceptance process against the stated requirements. In addition, we corresponded in writing with the Navy's assistant general counsel for research, development and acquisition to better understand how the LCS 1 and LCS 2 acceptance process complied with the acceptance requirements of subpart 46.5 of the FAR. We also relied on our prior work evaluating the LCS program and shipbuilding quality best practices to supplement the above analyses.

To evaluate the basis for and outcomes from the Navy's decisions to accept LCS 1 and LCS 2, we reviewed Navy and contractor documents detailing construction plans, costs, and schedules, including weekly SUPSHIP briefings, contracts, and earned value management reports. We also evaluated LCS 1 and LCS 2 trial plans and results and deficiency correction plans, as outlined in program acquisition strategies, SUPSHIP

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<sup>1</sup>For purposes of this report, we used the version of the FAR and DFARS in effect at the time that the LCS 1 and LCS 2 contracts were awarded.

<sup>2</sup>For purposes of this report, we used the version of the instruction in effect at the time that the LCS 1 and LCS 2 were accepted. In July 2012, following LCS 1 and LCS 2 acceptances, the Navy updated this instruction with a new version, OPNAVINST 4700.8J.

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and program office briefings, Navy Board of Inspection and Survey (INSURV) reports, and budget documentation. These steps enabled us to identify the key factors responsible for the Navy's decision to accept these ships. We also reviewed post-delivery basic ordering agreements, progress briefings, and Navy budget submissions to assess whether the Navy achieved the post-delivery cost efficiencies it anticipated when accepting delivery of LCS 1 and LCS 2. We reviewed 2013 fleet reports on equipment casualties to assess the extent to which deficiencies identified at LCS 1 and LCS 2 acceptances persisted when those ships were turned over to the fleet, and what effect those deficiencies have had on recent fleet operations. To determine the number and type of deficiencies for each vessel, we obtained and used data from the Navy's Technical Support Management (TSM) system. TSM is the primary database SUPSHIP uses to track the status of new ship construction deficiencies. We analyzed these data to determine the total number of open, starred deficiencies at key intervals including (1) when the Navy accepted delivery of each ship (preliminary acceptance); (2) at the end of each ship's guaranty period, approximately 8 months following preliminary acceptance; and (3) when the ships were transferred to the fleet, which the Navy indicated occurred in February 2013 for LCS 1 and February 2014 for LCS 2. Total starred deficiencies are those identified during acceptance trials. The data we collected represents the deficiencies at a particular moment in time. Further, deficiencies may be subdivided into multiple deficiencies or consolidated into a smaller number when the Navy and its shipbuilding contractors determine whether the government or the shipbuilder is responsible for correcting the respective deficiencies. We reviewed existing information about the data and the system that produced them, including previous data reliability testing performed on the same data collected for previous engagements on Navy shipbuilding, and interviews with agency officials knowledgeable about the data. We determined that the TSM data were sufficiently reliable for the purposes of this report for the ships we reviewed.

To further corroborate documentary evidence and gather additional information in support of our review for both objectives, we conducted interviews with relevant Navy and contractor officials responsible for managing LCS 1 and LCS 2 contracts, construction, acceptances, and post-delivery activities, including the Program Executive Office, LCS; LCS seaframe program office; LCS fleet introduction program office; SUPSHIP; INSURV; Office of the Chief of Naval Operations—Surface Warfare directorate; Naval Sea Systems Command (NAVSEA)—Contracts directorate; Lockheed Martin and Marinette Marine (LCS 1

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prime contractor and shipbuilder); General Dynamics and Austal USA (LCS 2 prime contractor and shipbuilder); and the American Bureau of Shipping. We also held discussions with attorneys from NAVSEA and the Office of the Assistant Secretary of the Navy for Research, Development and Acquisition.

We conducted this performance audit from November 2013 to September 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: Comments from the Department of Defense



ACQUISITION

THE ASSISTANT SECRETARY OF DEFENSE  
3015 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3015

SEP 12 2014

Ms. Michele Mackin  
Director  
Acquisition and Sourcing Management  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, DC 20548

Dear Ms. Mackin:

This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-14-827, 'LITTORAL COMBAT SHIP: Navy Complied with Regulations in Accepting Two Lead Ships, but Quality Problems Persisted After Delivery,' dated August 22, 2014 (GAO Code 121165). The Department acknowledges receipt of the draft report and notes that it contains no recommendations for DoD action as a result of your review.

The Department appreciates the opportunity to comment on the draft report. For further questions concerning this report, please contact Mr. James MacStravic, Deputy Assistant Secretary of Defense for Tactical Warfare Systems, at james.a.macstravic2.civ@mail.mil or 703-697-9386.

Sincerely,

  
Katrina McFarland

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

Michele Mackin, (202) 512-4841 or [mackinm@gao.gov](mailto:mackinm@gao.gov)

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## Staff Acknowledgments

In addition to the contact named above, key contributors to this report were Diana Moldafsky, Assistant Director; Christopher R. Durbin, Analyst in Charge; George Bustamante; Laura Greifner; Kristine Hassinger; Heather B. Miller; Roxanna T. Sun; and Ozzy Trevino.

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# Related GAO Products

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*Littoral Combat Ship: Additional Testing and Improved Weight Management Needed Prior to Further Investments.* [GAO-14-749](#). Washington, D.C.: July 30, 2014.

*Littoral Combat Ship: Deployment of USS Freedom Revealed Risks in Implementing Operational Concepts and Uncertain Costs.* [GAO-14-447](#). Washington, D.C.: July 8, 2014.

*Navy Shipbuilding: Opportunities Exist to Improve Practices Affecting Quality.* [GAO-14-122](#). Washington, D.C.: November 19, 2013.

*Navy Shipbuilding: Significant Investments in the Littoral Combat Ship Continue Amid Substantial Unknowns about Capabilities, Use, and Cost.* [GAO-13-738T](#). Washington, D.C.: July 25, 2013.

*Navy Shipbuilding: Significant Investments in the Littoral Combat Ship Continue Amid Substantial Unknowns about Capabilities, Use, and Cost.* [GAO-13-530](#). Washington, D.C.: July 22, 2013.

*Defense Acquisitions: Realizing Savings under Different Littoral Combat Ship Acquisition Strategies Depends on Successful Management of Risks.* [GAO-11-277T](#). Washington, D.C.: December 14, 2010.

*National Defense: Navy's Proposed Dual Award Acquisition Strategy for the Littoral Combat Ship Program.* [GAO-11-249R](#). Washington, D.C.: December 8, 2010.

*Defense Acquisitions: Navy's Ability to Overcome Challenges Facing the Littoral Combat Ship Will Determine Eventual Capabilities.* [GAO-10-523](#). Washington, D.C.: August 31, 2010.

*Littoral Combat Ship: Actions Needed to Improve Operating Cost Estimates and Mitigate Risks in Implementing New Concepts.* [GAO-10-257](#). Washington, D.C.: February 2, 2010.

*Best Practices: High Levels of Knowledge at Key Points Differentiate Commercial Shipbuilding from Navy Shipbuilding.* [GAO-09-322](#). Washington, D.C.: May 13, 2009.

*Defense Acquisitions: Overcoming Challenges Key to Capitalizing on Mine Countermeasures Capabilities.* [GAO-08-13](#). Washington, D.C.: October 12, 2007.

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Related GAO Products

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*Defense Acquisitions: Plans Need to Allow Enough Time to Demonstrate Capability of First Littoral Combat Ships.* [GAO-05-255](#). Washington, D.C.: March 1, 2005.



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